

Claims:

1. An apparatus for cavity enhanced optical detection comprising:

a) a source of optical radiation

b) a resonant optical cavity which provides a round trip path for said optical radiation
said cavity comprising:

i) a plurality of mirrors, a first mirror of said plurality being an input mirror which receives said optical radiation from said source and inputs same into said cavity;

ii) a flow cell positioned within said cavity, said flow cell comprising at least a first analysis channel which accommodates a flow of analyte fluid there through, the exterior wall of said at least first flow channel closest to said source of optical radiation intersecting said round trip radiation path at an angle approximately equal to Brewster's angle;

iii) a second mirror of said plurality of mirrors, which second mirror receives the radiation from said optical source after passage of said radiation through both said input mirror and said at least first analysis channel and reflects at least a portion of said received radiation;

whereby said resonant optical cavity provides a round trip path for analyte fluid having at least two different refractive index values and the location of the point at which said reflected radiation impinges on said input mirror is substantially the same as the point from which said first mirror inputs said radiation into said cavity notwithstanding changes in the refractive index of said analyte fluid or the wavelength of said radiation.

2. The apparatus of claim 1, wherein said first input mirror is concave and said second mirror is substantially planar.

3. The apparatus of claim 1, wherein said flow cell further comprises:

i) a second analysis channel which second channel intersects said radiation path at an angle which is substantially equal, but opposite to, the angle at which said first analysis channel intersects said radiation path; and

ii) a fluid inlet channel in fluid communication with both said first and second analysis channels.

4. An apparatus in accordance with Claim 1 which also comprises:

- a) a 50/50 beam splitter interposed between said optical source and said input mirror; and
- b) a photo-detector in optical communication with said beam splitter.

5. an apparatus in accordance with Claim 1 wherein said optical cavity and said flow cell comprise an integral structure.

6) An apparatus in accordance with Claim 1 wherein said optical cavity is a ring resonator which comprises: a concave input mirror and two substantially planar mirrors, said two planar mirrors covering at least a portion of two facets of a triangular prism with said concave input mirror facing the third facet of said prism, and wherein said analysis channel is positioned between said third face and said concave input mirror.

7) An apparatus in accordance with Claim 1 wherein said optical radiation is continuous wave.

8) An apparatus in accordance with Claim 1 wherein said optical radiation is pulsed.

9) An apparatus in accordance with Claim 1 wherein said source of optical radiation is a laser.

10) An apparatus in accordance with Claim 1 wherein said source of optical radiation is an incoherent light source.

11) An apparatus in accordance with Claim 1 wherein said source of optical radiation is mode match coupled to said resonant cavity.

- 12) An apparatus in accordance with Claim 1 wherein the wavelength of said optical radiation is variable over time.
- 13) An apparatus in accordance with Claim 1 wherein the interior wall surface of said at least one flow channel distal said source of optical radiation intersects said round trip radiation path at an angle approximately equal to Brewster's angle.
- 14) An apparatus according to Claim 1 which also comprises a semi-conductor diode photo detector.
- 15) An apparatus in accordance with Claim 1 wherein said source of optical radiation is broad band which after is dispersed onto an array detector.
- 16) An apparatus according to Claim 1 wherein said source of optical radiation is broad band and wherein light emitted from said optical cavity is dispersed onto a diode array detector.
- 17) A cavity ring down spectrometer incorporating the apparatus of Claim 1